As Sick as A Dog: Disease and behaviour in companion animals

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Understand Animals, UK

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Behaviour and disease

Homeostasis describes all the normal process inside the body & brain which maintain healthy balance.

However, disease processes result in the normal homeostasis mechanisms being compromised.

As a result the diseased animal has a different set of priorities eg

I need to eat more
I need to drink more
I need to sleep more
I need to get warmer
I need to avoid being touched

Change in resource value

Change in emotional responses

Change in offered behaviours

Change in learning potential

AS SICK AS A DOG …..
WHY DOES DISEASE AFFECT BEHAVIOUR

*Pain

*Inflammatory pathways (and stress responses)

*Effect on Gut-Brain-Axis influencing neurotransmitters

*Effects on sugar levels

*Brain electricity

*Normal brain cell function

*Effect on variety of hormones: thyroid, cortisol, aldosterone, testosterone etc

Inflammatory disease and behaviour

Studies where organic inflammatory agents are given to individuals, show that given for more than days, the recipients frequently develop anxiety disorders or depression.

Inflammatory agents within the body, such as cytokines have been linked to a number of changes within the blood, the gut and body and brain tissue, which change a whole host of processes.

Inflammatory disease drives imbalance.

What diseases in animals are associated with pro-inflammatory states?
*Gastroenteritis *Hepatitis *Pancreatitis *Cystitis *Osteoarthritis
*Neoplasia *Meningitis *Dermatitis among others

See also Piotti 2024 Gilbert 2025

Itchy makes you “witchy” & “twitchy”

A piece of research in 2019 showed that increasing itch severity in dogs with the skin disease atopy, was associated with a range of behaviour problems including hyperactivity, begging for and stealing food, attention seeking, excitability and reduced trainability.

In that study, the dogs with atopy did not differ from controls for trait-level scales associated with fearfulness/neuroticism, so the researchers concluded the itchiness (atopy severity) was the likely source of the problem behaviours rather than the temperament type of the dog predisposed them to the problems and the atopy.

Harvey 2019

Gilbert and colleagues (2025) found that cats with inflammatory conditions (including dermatitis) were more likely to have anxiety behaviour issues and to offer more connection seeking / care soliciting actions.

A study looking at dogs over 1 year of age who had been diagnosed with atopy where itchiness had been present for at least 3 months, found

Increases in

*Stranger directed aggression
*Owner directed aggression
*Familiar dog aggression

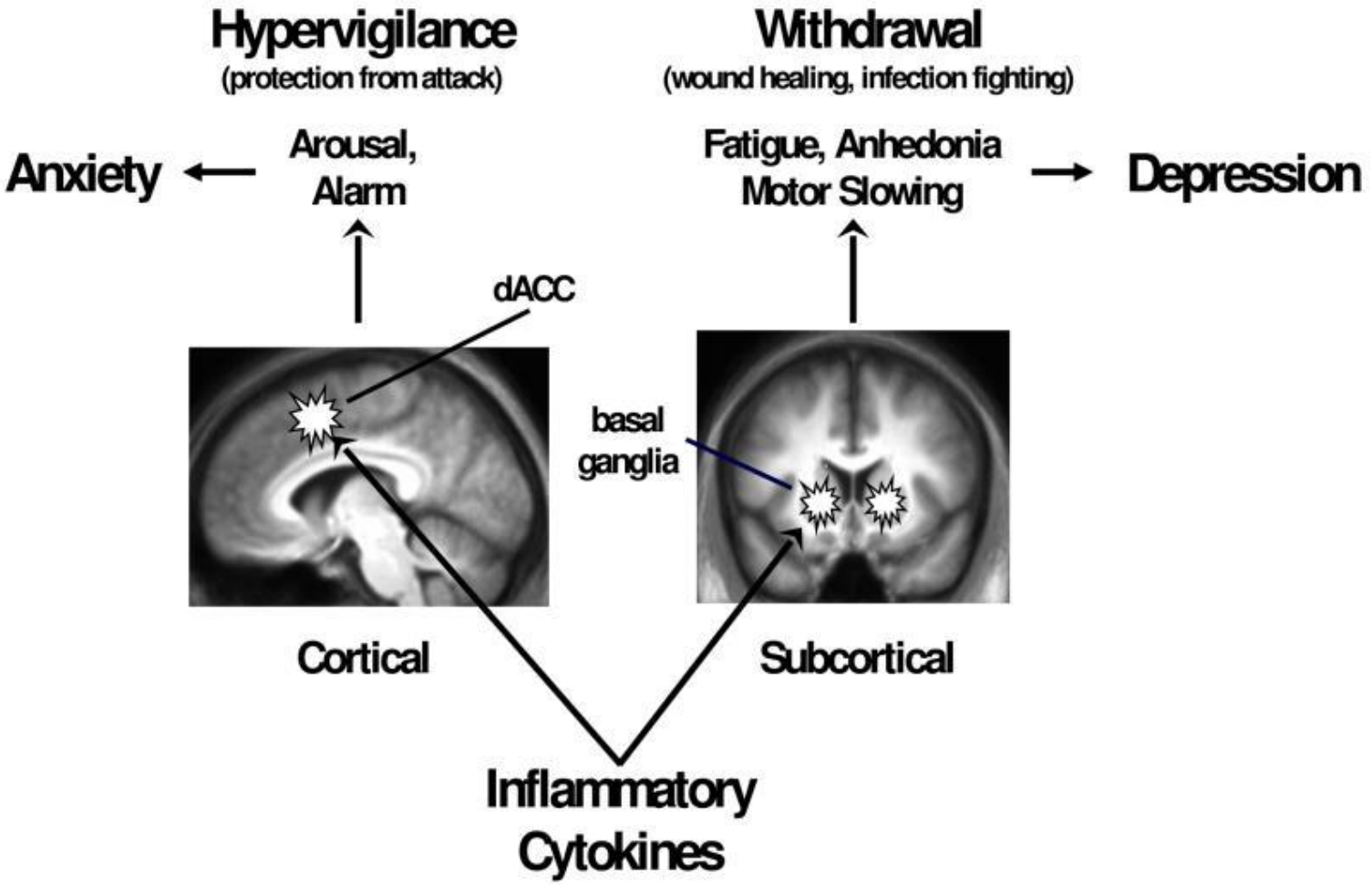
As well as
*Increased non social fear
*Increased touch sensitivity
*Increased excitability
*Increased attention seeking [connection seeking?!]
*Decreased trainability

“Chronically pruritic dogs experience fear and anxiety and are more likely to display aggression. This is an important welfare issue for these animals.”

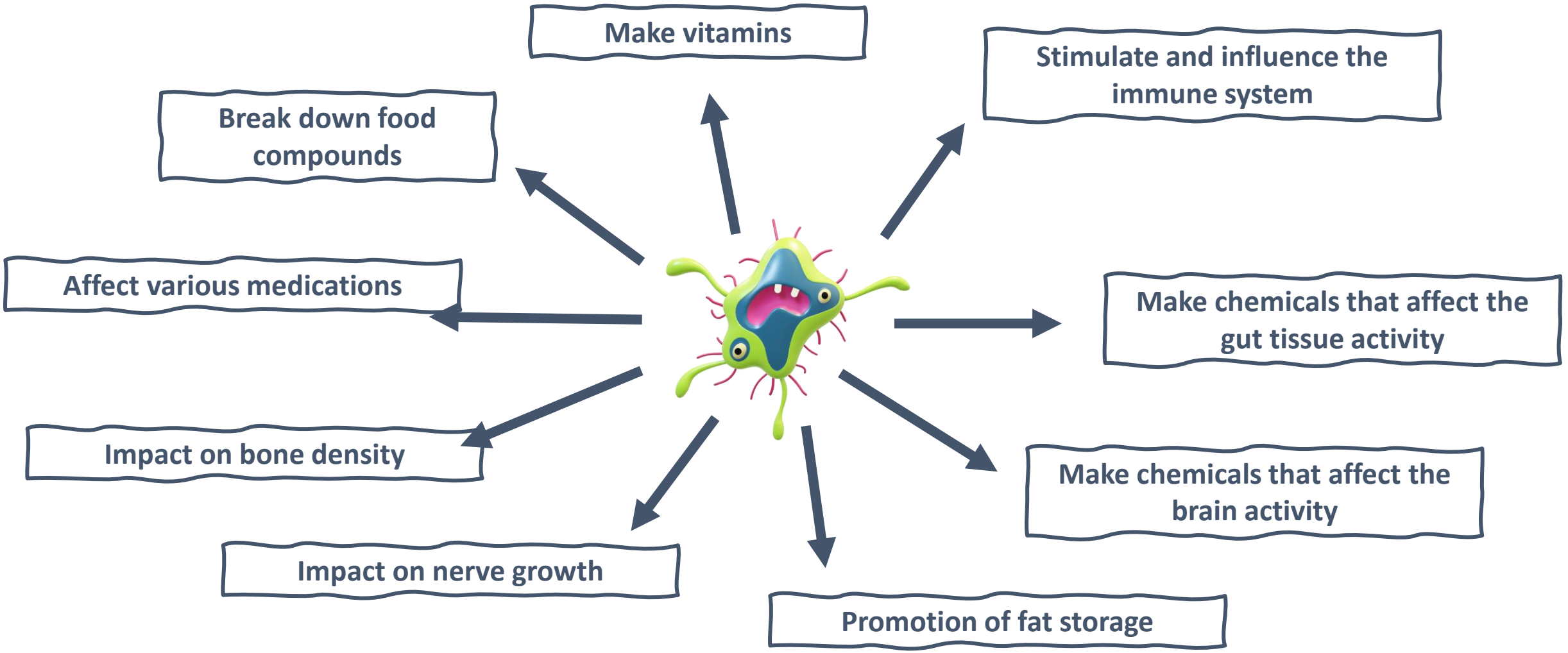
McAuliffe 2022

“It was suggested that emotional states might alter the normal intestinal microflora, increase intestinal permeability and contribute to systemic inflammation.
Since then, many aspects of this gut-brain-skin axis have been validated, and psychological and physical stress have been found to contribute to intestinal dysbiosis.
Studies in mice have shown that stress can impair the integrity and protective function of the epidermal barrier, causing fewer antimicrobial peptides to be produced in the skin, and an increase in the severity of infection and inflammation in the skin……
Atopic Dermatitis and indeed any other ‘skin disease’, may be seen as a possible manifestation of a more systemic problem involving gut dysbiosis and increased intestinal permeability, which may occur even in the absence of gastrointestinal signs.”

From Craig 2016

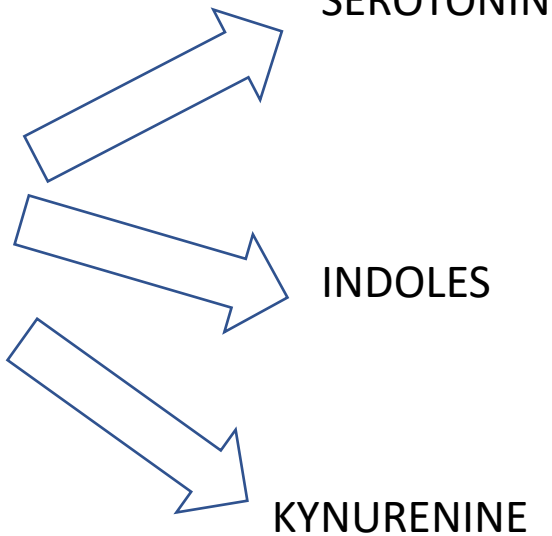


Thus, in combination, the effects of cytokines on these neurocircuits serve competing evolutionary survival priorities to lay low and conserve energy (the *conservation/withdrawal* response) while remaining on guard against future attack (the *hypervigilance* response). While these behavioral priorities are an essential component of the successful immunologic response to trauma or infection, in the context of chronic inflammation, this response can quickly become maladaptive, leading to chronic withdrawal (depression) and hypervigilance (anxiety). From Miller et al 2013



Understanding gut bugs and tryptophan

TRYPTOPHAN



SEROTONIN

INDOLES

KYNURENINE

Gut health / homeostasis

Immune system

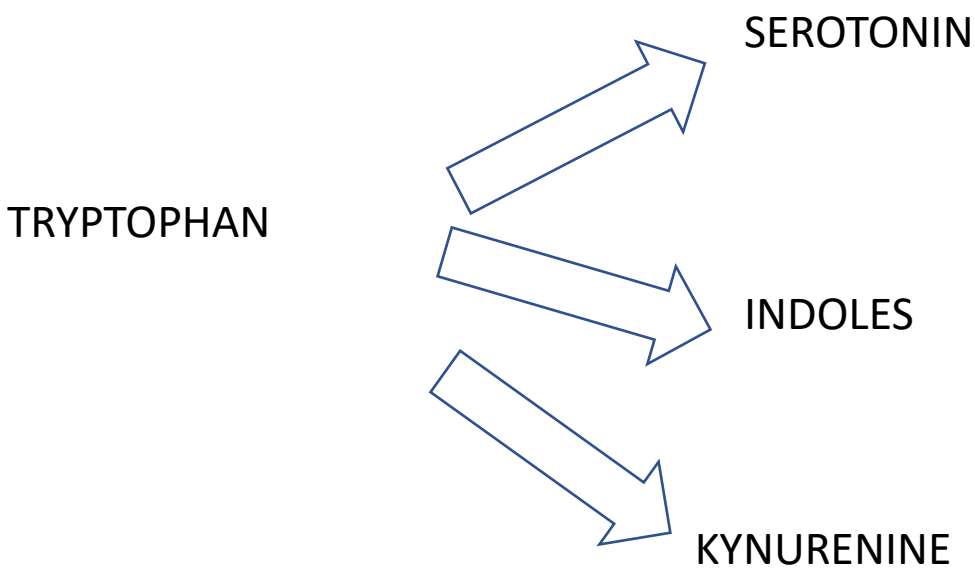
Chemical messengers affecting various behaviours and emotions

The types and health of the gut bugs & the amount of stress chemicals the dog is producing, affect whether gut bugs use tryptophan to make serotonin or whether to shift more of it into the Indole or Kynurenine pathway.

This affects the overall serotonin balance and the activity / including over activity, of the immune system (particularly inflammatory pathways).

See Miller 2013 for an overview of cytokines, brain and behaviour

Understanding gut bugs and tryptophan



BEHAVIOURAL OUTCOMES:

Anxiety
Irritability
Vigilance (Miller 2013)
Speed of responses
Learning capacity (See Chu 2021)
Repetitive behaviours
Perception of pain (Morreale 2022)

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See Miller 2013 for an overview of cytokines, brain and behaviour

From bugs to behaviour …

The intestinal microbiome produces a wide variety of chemicals (and building blocks for other chemicals)

Gut bugs (intestinal microbiota) are influencing:

- Serotonin
- Dopamine
- GABA
- Short chain fatty acids
- Inflammatory responses

and much more.

See also Franco 2021, Lalonde 2022

For more on gut bugs and their output and affect on behaviour:

Canine Behaviour In Mind edited by S Roger published by 5M

For an overview of gut bugs and behaviour in dogs and cats see Kiełbik 2024 as well as Gorzelanna 2024

Gut disease and behaviour

In humans, a variety of chronic gut diseases have been linked with behaviour changes such as anxiety, depression, irritability and sleep disorders. A variety of diseases in people are now being linked to imbalances in the gut, including but not limited to epilepsy, type 2 diabetes, autism, Alzheimer's and many of these disorders co-exist alongside behavioural change.

Gut pain / inflammation in the form of gastritis, ulceration or potentially enteritis have been linked with the development of abnormal oral behaviours such as pica and excessive licking in the dog and of course often cause pain (Becuwe-Bonnet 2012, Frank 2012, Poirier-Guay 2014)

A small number of studies have started suggesting the role of the gut health / the intestinal microbiota function in dog behaviour

Kirchoff 2019 Mondo 2020 Sunol 2020 Yeh 2022 Sacchettino 2025

Because of the complicated interplay between the gut bugs (intestinal microbiome), their “products” (metabolome) and the immune system, chemical messengers and the brain, normal digestive function and gut health are likely to play an essential role in many elements of health and behaviour.

There are multiple causes of chronic gut disease in the dog and cat:

*Types of chronic inflammatory enteropathy (often called IBD) which can be food responsive (FRD) antibiotic responsive (ARD) or steroid responsive (SRD)

*Bacterial infection eg Campylobacter, Salmonella
*Viral infection eg Parvo virus,
*Parasitic infection eg Giardia

*Neoplasia eg lymphoma
*Secondary enteropathy eg pancreatic disease,
kidney disease, heart disease

See Volkmann 2017 for consideration of CIE types in dogs

See Bandara 2023 for consideration of CIE in cats

Diagnosing gut disease in the dog & cat (a simplified guide)

*History taking

Faecal consistency (24/7, over weeks, not days)
Any vomiting, regurgitation, nausea (hypersalivation, head lowering, lip licking, repeated swallowing)
Appetite – noting any changes or significant abnormalities
Pica (in canines - coprophagia: others or self, dogs and cats - indigestible materials eg plastic, furnishing, cloths, clothing, toys, cardboard, plants)
Other signs of abdominal pain (unusual behaviours after eating, praying postures, excessive licking of self without primary skin disease or licking of surfaces, materials, panting, whining, withdrawal etc)

*Faecal assessment

Culture for "pathogenic" bacteria eg Campylobacter, Salmonella or viruses eg Parvo, Corona
Testing for parasites: Worm egg counts, larval flotation tests, Giardia, Cryptosporidium etc
Assessment of microbiome (???) and metabolome (???) SEE ZIESE 2021 for a microbiome review dogs & cats

*Blood tests

Assessing TLI (trypsin like immunoassay), cobalamin, folate, CSL/FSL (canine/ feline specific lipase)
General haematology and biochemistry (anaemia of chronic disease, inflammation, protein levels, urea, ALKP – alkaline phosphatase)

*Ultrasound / endoscopy / biopsies

*Food / medicine trials

Use of pre, pro and post biotics, along with faecal transplants remains of interest but controversial
See Atuahene 2024 and Salavati 2024 and Winston 2024

Diseases affecting sugars and behaviour

*Intestinal malabsorption

*Pancreatic insufficiency (EPI dogs, after pancreatitis cats & dogs)

*Diabetes mellitus

*Hyperadrenocorticism HAC often called Cushings (secondary DM)

- Increase value of food (food guarding, increase scavenging, coprophagia)
- Irritability / aggressive
- ?decrease sleep
- ?reduced trainability (or increased in some ?!)

Brain electricity abnormalities and behaviour

Dogs with Idiopathic Epilepsy received significantly higher post-onset scores for

*Dog-Directed Fear or Aggression
*Non-Social Fear
*Attachment/Attention-Seeking Behaviour
*Attention-Deficit
*and significantly lower “Trainability”

than prior to the onset of IE

From Watson 2020

Abnormal brain electricity

Petit mal (partial) seizures

Grand mal (full seizures)

The result of:

*Idiopathic epilepsy

*Metabolic disease

*Toxin ingestion

Symptoms petit mal:

*Randomly staring / glazed over

*Aggression for no known trigger

*Salivation / nausea during ‘seizure’

*Air snapping
*Circling
*Pacing
*Excessive tail chasing

“We found a weak correlation between seizure frequency reported by caregivers (subjective data) and ictal PD [paroxysmal discharge] frequency on AEEG (objective data), making it likely that the seizure underreporting phenomenon occurs in veterinary patients”
From Ukai 2021

Abnormal brain electricity

Petit mal (partial) seizures

Grand mal (full seizures)

The result of:

*Idiopathic epilepsy

*Metabolic disease
*Toxin ingestion

Diagnosis partial seizures:

Hard!
Very careful history taking
Video of dog

EEG during partial seizure
Ambulatory EEG where available (needs sedation for lead placement)
see Parmentier 2020

Response to treatment

See also:

Stassen 2019
Packer 2015

Brain electricity abnormalities and behaviour

“Epilepsy is one of the most common neurological disorders in humans and dogs. The role of microbiota in epilepsy remains unknown but it has been suggested that it is a possible influence of gut bacteria in controlling seizures. The aim of this study was to investigate the changes in gut microbiota from dogs with idiopathic epilepsy and the possible effect of antiepileptic drugs on the modulation of the composition of this microbiota.

In comparison with control dogs, drug-naive epileptic individuals showed a significantly reduced abundance of GABA and SCFAs-producing bacteria, as well as bacteria associated with reduced risk for brain disease.
Moreover, the use of phenobarbital or imepitoin monotherapy during one month in epileptic dogs did not modify the gut microbiota composition. These results open up the possibility of studying probiotic interventions in epilepsy”

From García-Belenguer 2021

See also Lum 2020

Cognitive dysfunction and behaviour

What is cognitive dysfunction and how do we recognize it?

Aging is a normal process.
Both in human and veterinary medicine, individuals could be categorized as:

Successful agers
Mild cognitive impairments
Severe cognitive impairments

Severe cognitive impairments are normally found in individuals with a specific set of pathological brain changes.

Common symptoms of this in dogs and cats include:

Anxiety (new fears, generalized anxiety, development of SRPs)
Disorientiation and confusion
Reduction in play and exploratory behaviours
Reduced social interactions (?other animals, new people / non caregivers)
Loss of house training (development of indoor toileting habits)
Changes in sleep-wake cycles (frequent night-time waking most common)

See Porvoost 2024 and also Haake 2024

Thyroid abnormalities & aggression

Under active thyroid (hypothyroidism) (most commonly affecting larger breed, middle aged to older dogs)

- controversial as to links to behaviour changes asides from lethargy and increased heat seeking
- potentially could increase anxiety (seen in humans) or irritability

"Associations have also been reported between serum thyroglobulin autoantibodies (TgAA), total T4 (TT4), free T4 (fT4), and TSH outside of normal reference ranges and the incidence of separation-related behavior problems, training problems, and coprophagia.

Proposed mechanisms for hypothyroid-related aggression include lowered threshold for aggression due to lethargy and irritability, impaired transmission of serotonin at the postsynaptic 5- HT2A receptors in the cerebral cortex and increased metabolism of serotonin in the cerebrospinal fluid (CSF).

Decreased CSF 5-HIAA concentrations have been linked to aggression in several species, including dogs."

However this study concluded no difference in thyroid hormone measurements between dogs showing a variety of aggression types and non aggressive dogs.

Radosta 2012

Symptoms of weight gain, lethargy, hair loss & skin infections are common in underactive thyroid cases

Thyroid abnormalities

Under active thyroid (hypothyroidism) (most commonly affecting larger breed, middle aged to older dogs)

- controversial as to links to behaviour changes asides from lethargy and increased heat seeking
- potentially could increase anxiety (seen in humans) or irritability

"The results of this study show only a weak and somewhat equivocal effect of thyroid hormone replacement therapy (THRT) in dogs with borderline thyroid hormone levels and owner-directed aggression.

As such, THRT cannot be wholeheartedly endorsed at this time for treatment of aggressive dogs with borderline-low thyroid status, as we defined it."

Dodman 2013

Diagnosing hypothyroidism:

*Cannot be done simply on circulating thyroid levels such as T4
*Often requires a panel of blood tests (Total T4, free T4, T3 , TAA, TSH)
*Ruling out of other concurrent disease due to euthyroid syndrome
*In some cases, where available, TSH stimulation test.
*Repeat tests.

Thyroid abnormalities

Under active thyroid (hypothyroidism) (most commonly affecting larger breed, middle aged to older dogs)

Overactive thyroid (hyperthyroidism) (more common in cats, rare in dogs)

- increased activity (pacing, restlessness) increased reactivity, increased irritability/aggression, panting, weight loss (or hard to maintain weight) with increased hunger and sometimes increased urination

Caused by:

*Tumour (in thyroid or brain)

*Diet (ingestion of dried / uncooked thyroid gland)

See Rotstein 2021 Kohler 2012

Diagnosis

*Elevated circulating thyroid levels (t4, free t4, t3, TSH)

*Ultrasound or CT of thyroid

(*Brain scan)

Abnormal steroid levels

*Hyperadrenocorticism (Cushings)

*Hypoadrenocorticism (Addisons)

Cushings (HAC)

Primary Cushings – pituitary vs adrenal
Symptoms:
*Increased thirst and urination
*Increased hunger
*Aggression / irritability
*Diabetes mellitus
*Recurrent infections (particularly skin / ears)
*Muscle loss (pot bellied appearance)
*Hairloss (often over back)
*Poor sleep patterns

"Hyperadrenocorticism may mimic signs of chronic anxiety by inducing anxiety-like physical changes due to consistently high levels of cortisol in the body (activation of the hypothalamic–pituitary–adrenal axis).

Animals may become more irritable and more aggressive. Increased appetite may be seen in early stages of the disease, together with polydipsia and polyuria. Many dogs with hyperadrenocorticism may exhibit exercise intolerance and avoid play, interactions and other physical activities."

From Denenberg et al 2017

Abnormal steroid levels

*Hyperadrenocorticism (Cushings)

*Hypoadrenocorticism (Addisons)

Cushings (HAC)

Primary Cushings – pituitary vs adrenal
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*Hairloss (often over back)
*Poor sleep patterns

Diagnosis – complicated !

Blood test: general
(increased ALKP)

Blood test: dynamic
ACTH stimulation test

Dexameth suppression test

Urine test
Creatinine:cortisol ratio

Ultrasound adrenal glands

Computed tomography
(adrenals and/or brain)

Abnormal steroid levels

*Hyperadrenocorticism (Cushings)

*Hypoadrenocorticism (Addisons)

Addisons

Primary Addisons (most common middle aged female dogs, rare in cats see Glebocka 2024)

Secondary – occurs after sudden withdrawal of high doses steroid medication

Symptoms (often vague):
*Intermittent loss of appetite
*Vomiting (often intermittent)
*Aggression / irritability (?) Increased anxiety (?)
*Tremoring

Diagnosis:

Blood test - general
Anaemia

Blood test – dynamic

ACTH stimulation test

Ultrasound adrenal glands

There are other diseases that can impact on behaviour:
(this presentation has not looked specifically at pain, either musculoskeletal, visceral, dermal or elsewhere eg head including dental, as an example)

For a fairly detailed overview see Camps et al 2019 and Canine Behaviour in Mind 2022 Chapter by A Batson

From kidney or liver disease to cancer to those changing other hormones (eg affecting the parathyroid) to structural brain disease or infections ..... Loss of cognitive capacity in Cognitive Dysfunction syndrome, or loss or certain senses eg sight, hearing, smell, may impact on a dog or cat's emotional state and therefore behaviour also.

It is not possible to rule out medical causes of behaviour issues from a general check up alone.

It is not possible to rule out medical causes of behaviour issues on a general blood test.

We have to play informed, educated detectives !!

We can get better at including health related questions in our consultations ....

Appetite / drinking / poo and urine / skin health (itchy?) / weight maintenance or changes

We are not playing vet, we are data collectors. The caregiver can data collect too – use diaries and videos etc.
Try to give the vet specifics – records of observations. And keep an open mind !

A dog/cat guardian, trainer and vet are in a bar…

Are we clear on any symptoms that are present? (Medical & / or behavioural)

How will we recognize change / progress?

OBSERVING
SCORING
RECORDING
MONITORING / COMPARING

NUMERICAL SCALES eg: 0 – 5 OR 0 -10

PROPORTIONS OF TIME as percentages / colour charts

INTENSITY OF RESPONSES In colour / number / verbal description

RECOGNISING IS EASIER WHEN RECORDED !!!

What does a healthy dog or cat look like?

As a non-vet professional, you will be seeing the dog or cat mostly from some distance.

- Demeanour - bright, inquisitive, interactive with environment / people
- Normal movement / gait (walk, trot, canter / run) (stand, sit, lie, step up/down)
- Tail movement / positioning
- Skin / hair
- Eyes - open, no obvious discomfort, no discharge
- Frequency of scratching / rolling / licking etc

Vets and caregivers will be having more intimate interactions leading to knowledge of further body regions such as inside the mouth, the ears, response to touch (vets – chest auscultation, abdominal palpation) etc

A dog/cat guardian, behaviourist and vet are in a bar...

*Appetite at each meal 0/5 no appetite, doesnt want to eat. 5/5 eats well and enthusiastically

*Grass eating 0/5 no grass eating at all 2/5 occasional grass eating but fairly easy to call away and doesnt immediately return
5/5 grass eating is common and frequent. Dog will spend several minutes or more doing this and not possible to distract.
Will often vomit grass or pass grass in their faeces. Returns to grass eating on a regular basis through out a 24 hour period

*Licking the environment 0/5 no licking of the environment 2/5 licks the floor, or furnishings on rare occasion across 24 hours
5/5 is frequently and repeatedly licking the floor or furnishings and is hard to distract.

*Licking themselves (define location) same scores as licking environment

*Belching-burping / soft cough Is this present? before or after eating? if yes, score similar to licking the environment

*Weight maintenance Easy or hard or neutral to maintain weight?

*Vomiting. Present? How often? Before during or after meals? Undigested food, partially digested food, bile?

*Faecal scoring 0/5 liquid 2/5 cow pat like but some sausage shape 3/5 sausage shape but leaves reasonable mark on ground where passed, sloppy to pick up 4/5 sausage shaped, easy to pick up with limited mark 5/5 dry and crumbly dog may strain to pass on occasion

Monitoring Progress:
REcognising is easier when REcorded

SAFETY	0-5	Where 0/5 is dog unable to settle 24/7, frequent extended whining / pacing / barking / vigilance often with scanning (or total withdrawal/shutdown) and 5/5 is positive mostly calm body language, able to make choices, settle for themselves, limited vocalizations, 24/7
INGESTION	0-5	Where 0/5 is dog has almost constant picky appetite or inhales all food in seconds with a lack of discrimination about what they eat, pica may be a feature. 5/5 is dog eats well, able to choose to leave some food alone, able to discriminate some tastes as unwanted versus preferred. Enjoys some regular chewing of edible items
BODY CARE	0-5	Where 0/5 is dog eliminates in own resting area or close to it, is unable to pass urine or faeces in a variety of appropriate places. May have symptoms of urinary or faecal issues eg loose poo regularly. 5/5 is a dog who can make choices close to 24/7 on where they toilet and urinary and faecal output is considered normal.
SLEEP	0-5	Where 0/5 is a score of under 10 hours sleep in 24 hours and sleep is regularly disturbed more than normal polyphasic cycles or where sleep is in excess of 16 hours in 24. 5/5 is 12-14 hours across 24 hours with ability to self settle, sleep for minimum 1-2 hours in each block, able to make choices where to sleep. (Cats sleep should be minimum 14 hours in 24)

Behaviours of concern:

BARKING AT NOISES OUTSIDE THE HOME		
	0-5	Where 0/5 is a dog who can hear sounds but seems comfortable to ignore them, may respond to particularly unusual or loud or high pitched noises including other dogs barks, with their own short response then consider the sound and make choice to interact or move away. 5/5 is a dog who reacts with intense barking to a variety of sounds which would normally be considered innocuous and barks for a prolonged period, unable to break away or make other choices even with positive human input.

THE BRAIN – BODY AND BEHAVIOUR ARE INTIMATELY CONNECTED, ARGUABLY INSEPARABLE

DISEASE ALMOST ALWAYS DRIVES BEHAVIOUR CHANGE IN SOME WAY

SOME BEHAVIOUR PROBLEMS ARE 100% THE RESULT OF DISEASE
SOME BEHAVIOUR PROBLEMS HAVE DISEASE (OR PAIN) AS A CONTRIBUTING FACTOR
SOME BEHAVIOUR PROBLEMS ARE INDEPENDENT OF DISEASE

See ... Camps 2019 Rogers 2022 Amat 2024 Mills 2024

BEING MORE MINDFUL OF HOW HEALTH AND DISEASE INFLUENCE BEHAVIOUR AND LOOKING FOR SIGNS TO SUPPORT THE VETS CARING FOR THE ANIMAL, WILL HELP US BE MORE EFFECTIVE AT SUPPORTING COMPANION ANIMALS AND THEIR CAREGIVERS

Thank you for inviting me to speak.

Understand Animals. UK

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